1. **INTRODUCTION: Big overarching topic**
   1. Urbanization and Sustainability
      1. Urban areas are the peak example of human dominated landscapes and are continuing to expand driven by increasing urbanization around the globe (Seto, Sanchez-Rodríguez, & Fragkias, 2010).
      2. The expansion of urban populations has led to the introduction of an urbanization science to explicitly study the ways that urbanism impacts the environment (Solecki, Seto, & Marcotullio, 2013).
2. **Two Literatures:**
   1. Urban Ecologists have shown that conventional urban sprawl is unsustainable and drives environmental degradation (Johnson, 2001).
   2. Urban Designers have developed alternatives to conventional development with strategies for mitigating environmental degradation; however, these alternatives remain largely untested (Conway, 2009).
3. **Highlight the Gap**
   1. Scholars have addressed the effects of urban form on microclimate regulation at the city scale (Li et al 2017). As well as some of the implications of sustainable design practices on the generation of ecosystem services (Turner & Galletti, Do Sustainable Urban Designs Generate More Ecosystem Services? A Case Study of Civano in Tucson, Arizona, 2015) However, scholars from these fields have yet to fully address the how these relationships vary across the urban to rural transect.
4. **Introduce Research Questions**
   1. **How does the Composition and Configuration of Urban form impact microclimate regulation and ecosystem service generation?**
   2. **What effects do the design principles of New Urbanism have on microclimate regulation?**
   3. **How do these effects vary across the Urban to Rural Transect?**
5. **Literature Review**
   1. **Sustainable Development:** The urban landscape in America is dominated by suburban single-family residential development.
      1. This conventional development, otherwise known as urban sprawl, is land intensive and is an acute driver our automobile dominant culture. – (Ewing et al 1994)
      2. Scholars have shown that sprawl based development has wide ranging environmentally detrimental impacts.
         1. Ecological Homogenization – (Harris, et al., 2012)
         2. Fertilization and resource use – (Fraser, Bazuin, Band, & Grove, 2013)
         3. Urban Heat Island – (Oke, 1995)
         4. Transportation – (Source)
      3. Similarly, urban sprawl is also a driver of economic and social issues. The decentralized urban form requires the use of an automobile.
         1. Economic Issues occur at the municipality scale because the diffuse tax base doesn’t generate enough revenue to maintain infrastructure or properly support a city. (Duany, Plater-Zyberk, & Speck, 2000)
         2. Social Issues can come from several sources
            1. The same distance and lack of transit mechanism that isolates sprawl from the inner cities also creates an accessibility issue for those who are not easily mobile. (Popenoe (1979) +)
            2. Placelessness (Duany, Plater-Zyberk, & Speck, 2000)– The inability to identify your location based on your surroundings.

Previously was referred to as “Environmental Deprivation” (Popenoe 1979)

Closely tied to the idea of a sense of community.

Placelessness is concerning because people tend not to care about places like these.

* + - * 1. Public Health

No access to public transit or active transit infrastructure reduces overall activity levels and contributes to obesity.

Additional health concerns include:

Asthma from emissions

Increased traffic deaths and injuries (Duany, Plater-Zyberk, & Speck, 2000)

* + 1. Design-Oriented Approaches to remedy sprawl: Several Design Oriented “interventions” have been proposed to promote a more sustainable urbanism. (Conservation Subdivision – Arendt 1996, New Urbanism – Duany, Plater-Zyberk, and Speck 2000, Sustainable Urbanism (Farr, 2007), Garden City – Howard (?), Biophilia (?))
       1. New Urbanism was originally developed as a response to sprawl but recently developed a set of tools for promoting sustainability as well as a vibrant urban lifestyle.
          1. New Urbanism is a set of design principles that promotes urban vitality through dense, mixed-use development.

These developments are characterized by interconnected transit with a focus on multi-modal transportation; Incorporation of greenspace, development of resilient businesses, and a sensitivity to the context of the community surrounding the development. (Duany, Plater-Zyberk, & Speck, 2000) (Farr, 2007)

* + - 1. Begun to move towards a form of environmentalism with the introduction of the Cannons of sustainable architecture.
  1. **Social-Ecological Systems and Ecosystem Services:** 
     1. Urban Ecology: As scholars and designers are readdressing the standing principles of urban planning, they are incorporating an emphasis on urban ecology.
        1. Urban areas have become accepted and identified as social-ecological systems and consequently are considered a primary nexus of human interactions with the environment (Grimm, et al., 2008).
        2. The Social Ecological systems framework (Ostrom, 2007) provides a framework for understanding the ways that humans and nature interact.
        3. The Ecosystem services framework originating from the Millennium Ecosystem Assessment provides an alternative understanding of human and ecosystem interactions (Millennium Ecosystem Assessment, 2003)
           1. Many studies have used ecosystem services as a framework for understanding the environmental impacts of cities. [Specifically, new urbanism and eco services (Turner & Galletti, Do Sustainable Urban Designs Generate More Ecosystem Services? A Case Study of Civano in Tucson, Arizona, 2015), Urban Ecosystem Services and management (Ernstson, Barthel, Andersson, & Borgström, 2010)]
        4. While these frameworks were developed separately there is a degree of overlap between them that can aid in a complete understanding of urban ecosystems.
        5. Studies have shown monetary benefits of investing in ecosystem services such as urban parks and greenspace. (Elmqvist, et al., 2015)
     2. Regulating Services
  2. **Urban Form, Composition and Configuration**
     1. Technical dimensions of environmental sustainability (Trudeau, 2013) and (Williams & Dair, 2007) vs. “Behavioral”
        1. Changes to the built environment, that directly impact the sustainability.
           1. Examples include: Changes in materials, design strategies that are more context sensitive.
        2. Development of land fundamentally changes the areas environmental and ecological characteristics.
           1. New Urbanism, as well as conventional subdivision development will have direct impacts on the “technical sustainability” (Trudeau, 2013) via the differences in urban form that they create.
           2. How will these impacts vary between the two and across the urban transect?

1. **Methodology**
   1. State RQs:
      1. How does the composition and configuration of urban form impact microclimate regulation and ecosystem service generation?
         1. Urban form can be composition and configuration can be detected using remote sensing techniques
      2. What effects do the design principles of New Urbanism have on microclimate regulation?
      3. How do these effects vary across the Urban to Rural Transect?
   2. Land Systems Science Theoretical Framework
      1. Literature:
         1. B.L. Turner on Land Systems Architecture
         2. Oke on UHI
         3. Xiao Xiao Li on methods
         4. (Conners, Galletti, & Chow, 2013) on UHI and Landscape characteristics using LST from Aster Data
         5. Addressing Climate Change through Design (Turner & Galletti, 2017)
   3. Three Study Sites: Moule and Polyzoides Architecture Firm
      1. Three sites selected in the American Southwest by the Moule and Polyzoides Architecture Firm. Choosing locations with similar climatic influences acts as a control for data comparisons.
         1. Civano New Town, Tucson
         2. Lancaster Boulevard, Lancaster California
         3. Mercado District Rio Nuevo, Tucson
   4. Specific Steps
      1. Classify 1-Meter NAIP Imagery for three locations in Google Earth Engine
         1. Imagery
      2. Create Land Surface Temperature Dataset from Aster Data
         1. Following (Conners, Galletti, & Chow, 2013)
      3. Compute Landscape Metrics in Fragstats (McGarigal & Marks, 1995)
      4. Microclimate analysis with ASTER and NDVI in a GIS (Arc or Q)
      5. Mixed Effect Models / Spatial regression
2. **Timeline/Budget**
3. **Conclusion**

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